Managing Patients with Temporary Tracheostomy Tubes

Lila K. Sierra, CVT, VTS (Emergency & Critical Care)

A temporary tracheostomy tube (TT) is a device placed in the trachea, between the tracheal rings, through a surgical opening called a tracheotomy. It provides access to the lower airways, allowing:

- Airway protection
- Airway patency (if upper airway is obstructed)
- Access for airway hygiene
- Mechanical ventilation.

The most common indication for TT placement in small animal practice is upper airway obstruction, often due to brachycephalic airway disease or laryngeal paralysis or masses.

TYPES OF TRACHEOSTOMY TUBES

A variety of tracheostomy tubes are available (**Figure 1**, page 64); each has advantages and disadvantages that may impact your approach to management.

Materials

- **Silicone tubes** are soft, flexible, and most can be resterilized (Shiley and Bivona types).
- **Polyvinylchloride tubes** are stiffer and single use/disposable (Portex and Rushlit types).
- **Metal tubes** are stainless steel or silver, easy to clean, and can be repeatedly autoclaved (Negus, Chevalier, Jackson, and Alderhey types).

Cannulas & Cuffs

Depending on their diameter, TTs can:

- Have **single** or **double cannulas**:
  - » Double cannula TTs are easier to maintain because the inner cannula can be removed aseptically and cleaned, leaving the outer cannula in the trachea.
  - » If a single cannula tube becomes obstructed by mucus and cannot be unoccluded, the entire tube must be replaced.
- Be **cuffed** or **uncuffed**:
  - » Cuffed TTs can be used for anesthesia and/or mechanical ventilation, protecting the airway from aspirated material.
  - » Cuff presence increases external diameter of the tube; therefore, a cuff may not be usable in tiny patients.

TMP **BRACHYCEPHALIC BREEDS** present unique challenges with regard to temporary TT care. Read **Brachycephalic Breeds: Thwarting Tracheostomy Tube Troubles** at **todaysveterinarypractice.com** (select Resources).

TRACHEOSTOMY TUBE & STOMA CARE

Double Cannula Care

1. **Inspect the inner cannula:**
   - Examine the cannula at least every 2 to 4 hours.
   - Patients producing excessive mucus may require care every 30 minutes, or more often.
2. **Clean the inner cannula:**
   - Using sterile gloves, remove the cannula (leaving outer cannula in place).
   - Soak it in a sterile bowl containing 3% hydrogen peroxide; the peroxide will loosen any material within the lumen.
   - Use sterile pipe cleaners or brushes to completely remove debris.
   - Rinse thoroughly in a separate bowl with sterile saline or water; carefully remove any peroxide that could irritate the tracheal mucosa.
   - Gently shake or dry the tube with sterile gauze; then replace in the outer cannula or sterily store.

Single Cannula Care

3. **Inspect the single cannula:** Listen to changes in pitch or place a hand, tuft of cotton, or glass slide in front of the tube opening to detect decreased air flow.
4. **Clean the single cannula:**
   - Carefully introduce a moistened sterile cotton swab or pipe cleaner into the cannula to remove any visible debris.
   - Do not let the swab or pipe cleaner occlude the airway or loosen material, pushing it into the airway.
   - Replace the entire TT if you do not feel you can confidently and effectively clear the cannula.

Complication Prevention

5. **Note consistency of respiratory secretions:** Changes may indicate bleeding, infection, or tissue necrosis.
6. **Remove and replace the TT if all efforts to remove an obstruction have failed:** Especially if clinical signs indicate airway is obstructed (**Figure 2,** page 64).

Figure 1. *TT examples: Shiley cuffed double cannula—note removable translucent inner cannula on right (**left**); Shiley cuffed single cannula (**middle**); Jackson double cannula—note removable inner cannula on right (**right**)*

Figure 2. *Example of tube occlusion: The inspissated plug most likely consisted of mucus, inflammatory cells, and sloughing tracheal epithelial cells. Efforts to remove the plug through the outer cannula were unsuccessful, requiring immediate replacement of the entire TT.*

Figure 3. *Posey Cufflator manometer (**left**) and traditional air syringe (**right**)*

Figure 4. *Tracheal stoma: the serosanguinous discharge exiting the caudal portion of the stoma is not uncommon; however, note discharge characteristics and clean the site carefully without entering the stoma.*

7. **Readjust balloon pressure in cuffed TTs every 4 hours:** This minimizes tracheal mucosal damage.
   - Special cuff manometers (Posey Cufflators, posey.com) accurately measure cuff pressure (**Figure 3**).
   - A syringe can be used to change air pressure in the cuff.

Stoma Site Care

8. **Monitor stoma site at least every 4 hours:** Look for signs of inflammation, pain, discharge, or subcutaneous emphysema (**Figure 4**).

9. **Clean the skin around the stoma:**
   - Use gauze squares with 2% chlorhexidine scrub or 3% hydrogen peroxide diluted 1:1 with water.
   - If needed, gently clean the tender tissues inside the stoma with sterile cotton swabs moistened with sterile saline.
   - Do not allow any ointments or scrub to contact tissues inside the incision.

10. **Change neck ties** (Velcro or umbilical tape) that hold the TT in place when soiled.

MEDICAL MANAGEMENT

To understand how a TT affects a patient's airway, see **What Happens to the Airway?**.

Systemic Hydration

Because airway secretions are 90% water, airway clearance becomes difficult if the patient is systemically dehydrated.

TEMPORARY TRACHEOSTOMY TREATMENT

1. **Comfort/anxiety check Q 1 H**
2. **Auscult Q 2 H; more often if necessary**
3. **Examine TT Q 2–4 H**
   - Examine more often if necessary
   - Suction when necessary
   - Flush ONLY if necessary
4. **Cannula care Q 2–4 H**
   - Remove and clean cannula
   - Note character of secretions
   - If secretions are productive, care may be continuous
5. **Stoma care Q 4–6 H**
   - Clean around stoma
   - Note character of the site: discharge presence/type, inflammation, subcutaneous emphysema, etc
   - Evaluate potential obstructions from neck folds; if applicable, consider neck fold suture
6. **Nebulize and coupage Q 4–6 H**
   - Certain cases may require continuous nebulization (ie, severe pneumonia)
   - Alternate with humidification in between nebulization sessions where applicable
7. **Deflate/monitor cuff pressure Q 4 H**
8. **Replace TT when necessary**
9. **Fluid/hydration check Q 2 H**
   - Ensure patient is on appropriate fluids and correct fluid rate
   - Monitor systemic hydration

Figure 5. *Airlife bubbler humidifier with an Ohmeda oxygen flowmeter, oxygen tubing, and face mask*

Figure 6. *Nebulization of a calm tracheostomy patient*

Figure 7. *Airlife nebulizer cap with Ohmeda oxygen flowmeter and corrugated plastic tubing*

Maintain systemic hydration using intravenous fluids, while simultaneously providing moisture directly to the airway using humidification and/or nebulization.

Airway Humidification

There are several ways to humidify the airway:

- **Oxygen bubblers** are easy to use and cost efficient (**Figure 5**). They saturate inhaled oxygen with water vapor.
- **Heated humidifiers**, most commonly associated with mechanical ventilators, are very effective but can be costly. Warm air carries more water vapor, increasing the number of water molecules delivered to the airway. Take care to avoid thermal damage to respiratory tissues: do not set the thermostat too high.

Nebulization

Nebulizers are the most effective way to moisten the airway, delivering large volumes of liquid to the airways (**Figure 6**).

- Nebulizers deliver water as liquid droplets (mist) as opposed to humidifiers, which deliver water vapor.
- They are typically filled with 0.9% or 0.45% saline rather than water; administration of large amounts of water would be excessively hypotonic for airway mucosa.
- Nebulization is particularly useful in patients with pneumonia. The liquid droplets loosen secretions, allowing the patient to eliminate them with relative ease.

Pneumatic nebulizers (also called jet nebulizers or atomizers) create mist from a pressurized source, such as compressed air or an oxygen supply. They can be bulky, noisy, and produce unpredictable water droplet size; however, if driven by pressure from an oxygen outlet, the patient receives the dual benefit of oxygenation and nebulization (**Figure 7**).

Ultrasonic nebulizers produce more predictable droplet size due to their transducer source; however they can be costly and cannot deliver oxygen.

Nebulization sessions are adjusted based on the patient's needs. For example, a routine TT patient without pneumonia could be nebulized for 15 minutes every 4 to 6 hours, with a humidifier alternated between sessions. A TT patient with severe pneumonia and copious secretions, however, may benefit from continuous nebulization.

Observe for airway irritation, bronchospasm, systemic overhydration, hyperthermia, and iatrogenic infections and treat accordingly.

Medications

Medications, such as **bronchodilators** or **antibiotics**, can be administered if added to the saline in a nebulizer. However, drug efficacy depends on:

- Patient compliance and tolerance
- Distribution variability of the drug to affected tissues.

Antitussives may be needed for patients who displace their TTs by coughing.

WHAT HAPPENS TO THE AIRWAY?

A normal airway requires a great deal of hydration to maintain mucociliary escalator function. When the upper airway is bypassed by the TT, the lower airways are exposed to arid air, which dries out delicate tissues and causes inflammation.

- The dry airway reacts by producing increased amounts of thick, viscous mucus.
- Inflammation results in influx of copious numbers of inflammatory cells, such as neutrophils and macrophages.
- Because the lower airways are no longer protected from bacteria, they are susceptible to infection and possibly pneumonia.[1]
- In addition, TTs, especially those that are fitted tightly or cuffed, may cause pressure damage or even necrosis of the tracheal mucosa.

All of these factors lead to a high likelihood of excessive mucus production, leading to risk for obstruction.

Reference

1. King LG, Sierra LK. Artificial airway management. *Advanced Monitoring and Procedures for Small Animal Emergency and Critical Care*. Hoboken, NJ: Wiley-Blackwell, 2012, pp 318-339.

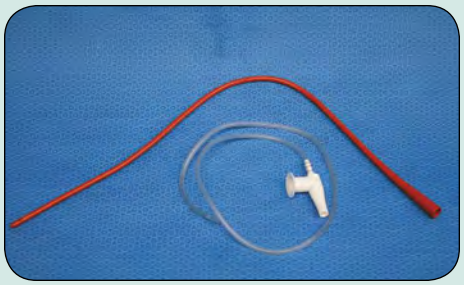

Figure 8. *Bard red rubber catheter; note lack of proximal "thumb port" for suction control and only 1 fentestration at the tip (**top**) compared to the Kendall Safe-T-Vac (**bottom**)*

Figure 9. *Central vacuum system equipped with a suction regulator connected to a portable suction canister*

STEP BY STEP: TRACHEOSTOMY TUBE SUCTIONING

1. For a conscious, spontaneously breathing patient, have a staff member comfort and gently position the patient. Consider administering a mild sedative to reduce anxiety or panic.
2. Pulse oximetry and ECG optimize monitoring during the procedure.
3. Oxygenate prior, in between, and after each suction pass to avoid iatrogenic hypoxia.
4. Wearing sterile gloves, advance the catheter into the lumen of the TT, no more than a few centimeters beyond the end of the TT.
5. Twisting the suction catheter in a circular motion, withdraw it while tapping the proximal port to produce intermittent suction. Perform this step quickly (≤ 5 sec) to reduce amount of time patient is without oxygen.
6. Once suction catheter is removed, reoxygenate and allow a brief (few min) recovery period.
7. Determine procedure success by auscultation and listening to the patient's breathing.
8. Base the frequency of suctioning on the amount and viscosity of the secretions.
   - Suction passes should be limited to no more than 2 to 3 times a session (see **Caution**).
   - If an obstruction cannot be successfully alleviated within that given time, it is best to replace the entire TT.

Caution: *Suctioning aggressively or advancing the catheter too far into the airway may cause severe coughing, bronchospasm, vomiting, or a vagal episode.*

Coupage & Chest Physiotherapy

After nebulization, coupage is performed by gentle clapping on the chest wall, which can break up debris and provoke a cough reflex, helping manage airway clearance. While coughing is encouraged, monitor it closely as the TT can be inadvertently removed by forceful coughing.

Walking a patient short distances after nebulization is an alternative to coupage, as activity will increase tidal volume, stretch the airways, and promote coughing.

Suctioning

Suctioning the TT is an important part of airway hygiene. Respiratory secretions can become trapped within the TT's lumen or in the airway below, causing an obstruction.

A majority of alert patients can cough debris out through the TT, especially during nebulization. However, if the cough reflex has been suppressed (eg, from sedation or anesthesia), clearance of an obstruction may require medical intervention.

Many suction catheters are specifically designed for this purpose.

- The ideal catheter should be sterile, soft, flexible, and provide a proximal port to control amount of suction. Red rubber urinary catheters can be used alternatively, but they make suction difficult to control (**Figure 8**).
- The suction catheter should be small enough to easily pass through the lumen of the TT, but large enough to remove thick secretions and debris.
- The catheter should connect to a suction canister and vacuum system—the canister acts as a collection system, protecting the vacuum system from inadvertent contamination (**Figure 9**).
- A suction flow meter provides optimal suction control. The recommended suction range is between 80 and 120 mm Hg; higher flows may worsen airway collapse or atelectasis.[1]

The suction procedure can be accomplished by 2 people, but additional staff should be alerted in case more help is needed. For a description of the procedure, see **Step by Step: Tracheostomy Tube Suctioning**.

Occasionally a patient with a stubbornly obstructed TT may require instillation of sterile 0.9% saline (2–3 mL/time) into the TT to moisten dried debris that can then be suctioned. This technique is controversial due to the risk of forcing mucous plugs into the lower airway, occluding smaller bronchi, triggering inflammation and bronchospasm, and/or introducing iatrogenic pneumonia. Only use this method with extreme care and as a last resort.[2]

PATIENT CONSIDERATIONS

Housing

Patients with TTs in place should be located in an easily accessible, relatively quiet central area.

- Choose an area that is not only visible but also audible—

IN CASE OF EMERGENCY

Emergency situations, such as airway obstruction or sudden TT displacement, can arise at short notice. It is crucial to have a team ready at all times, prepared with the proper supplies.

- While 2 people are required, each situation is different; therefore, it is vital that the entire staff be available if more hands are needed.
- A bedside "trach station" should be laid out by the patient's cage to decrease reaction time should an emergency develop.

TEMPORARY TRACHEOSTOMY BEDSIDE STATION

Tracheostomy Equipment
- Several backup tracheostomy tubes
- Disposable inner cannulas
- Air syringe or air manometer for cuffed tubes
- TT ties (umbilical tape or velcro ties)

TT Care Kit*
- Sterile, unfenestrated drape (sterile field)
- 2 sterile bowls: 1 to soak tube and 1 to rinse†
- Sterile gauze squares and cotton swabs
- Sterile pipe cleaners or small brushes
- Hydrogen peroxide: For soaking TT
- Bottle of sterile water or saline: For rinsing TT (for that purpose and patient only)

Suction Equipment
- Suction canister and vacuum system
- Suction tubing
- Suction catheters

Additional Supplies
- Sedatives: At discretion of clinician
- Heparinized saline flush: To flush IV catheters after sedation
- Sterile gloves: For direct handling of TT§
- Nonsterile gloves: For handling patient§

Monitoring Equipment
- Pulse oximetry and ECG

* TT care kits are also commercially available; take care to keep these kits sterile.
† Quickly clean and resterilize used TTs (eg, metal TTs) to ensure continued availability.
§ Store several sizes of gloves to accommodate all staff.

Consider running practice drills with staff to play out different scenarios, which prepares your team for any situation and builds confidence. For example:

- Patient A has been resting comfortably but has a high pitch whistle emanating from his TT as he breathes.
- Patient B has been stable but suddenly removed the TT with his paw.
- Patient C has developed an obstruction distal to the TT and is panicking and struggling.

early signs of obstruction are easily recognizable by listening to the patient's breathing.

- Avoid confining the patient to an oxygen cage because it is almost soundproof and hinders auditory monitoring.
- However, if the patient needs to be in an oxygen cage:
  - » Dedicate a team member to the patient
  - » Increase monitoring, such as continuous pulse oximetry and electrocardiography (ECG)
  - » Alert other staff members, allowing them to assist in observing the patient.

Comfort

Anxious, stressed patients can become hyperthermic and increase the likelihood of airway obstruction.

Some TT patients have trouble adapting to a temporary airway.

- Patients with chronically obstructed airways may sleep in a specific position; however, this position may obstruct the TT.
- The skin incision can be uncomfortable and the TT and its ties can rub, causing irritation and discomfort.

Management of TT patients includes rehabilitating them to their new airways.

- Teach the patient how to comfortably lie down and arrange bedding to accommodate the new sleeping position.
- Administer mild analgesics or anxiolytics to provide comfort and allow increased longevity and patency of the TT. ■

ECG = electrocardiography; TT = tracheostomy tube

References

1. Raffe MR. Respiratory care. *The Veterinary ICU Book*. Jackson, WY: Teton NewMedia, 2002, pp 147-165.
2. Clare M. Care of the ventilator patient. *Small Animal Critical Care Medicine*. Philadelphia: Saunders, 2009, pp 912-916.

***Lila K. Sierra**, CVT, VTS (Emergency Critical Care), is the assistant nursing supervisor of the Intensive Care Unit at University of Pennsylvania's Matthew J. Ryan Veterinary Hospital. She is immersed in nursing care on clinical and academic levels. Ms. Sierra's passions lie in advanced nursing care, including patient advocacy, innovative nursing development, and education of veterinarians and veterinary technicians. She has lectured at state conferences and recently published a chapter in* Advanced Monitoring and Procedures for Small Animal Emergency and Critical Care.